

# Package ‘autoTS’

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**Type** Package

**Title** Automatic Model Selection and Prediction for Univariate Time Series

**Version** 0.9.11

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**Description** Offers a set of functions to easily make predictions for univariate time series. 'autoTS' is a wrapper of existing functions of the 'forecast' and 'prophet' packages, harmonising their outputs in tidy dataframes and using default values for each. The core function `getBestModel()` allows the user to effortlessly benchmark seven algorithms along with a bagged estimator to identify which one performs the best for a given time series.

**License** GPL-3

**Encoding** UTF-8

**LazyData** true

**Imports** rlang, prophet, dplyr, magrittr, lubridate, tidyr, forecast, ggplot2, RcppRoll, shiny, shinycssloaders, plotly

**BugReports** <https://github.com/vivienroussez/autots/issues>

**URL** <https://github.com/vivienroussez/autoTS>

**Suggests** knitr, rmarkdown, stringr

**VignetteBuilder** knitr

**RoxygenNote** 7.1.0

**NeedsCompilation** no

**Repository** CRAN

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|             |   |
|-------------|---|
| complete.ts | <i>Creates additional dates and values when NA where removed and the TS is not complete</i> |
|-------------|---|

---

### Description

Creates additional dates and values when NA where removed and the TS is not complete

### Usage

```
complete.ts(dates, values, freq, complete = 0)
```

### Arguments

|          |   |
|----------|---|
| dates    | A vector of dates that can be parsed by lubridate   |
| values   | A vector of same size as dates  |
| freq     | A character string that indicates the frequency of the time series ("week", "month", "quarter", "day"). |
| complete | A numerical value (or NA) to fill the missing data points   |

### Value

A dataframe with 2 columns : date and val, with additional rows

**Examples**

```
library(lubridate)
library(dplyr)
dates <- seq(as_date("2000-01-01"), as_date("2010-12-31"), "month")
values <- rnorm(length(dates))
complete.ts(dates, values, "month", complete = 0)
```

---

getBestModel

*Determine best algorithm*


---

**Description**

Implement selected algorithms, train them without the last `n` observed data points (or `n_test` number of points), and compares the results to reality to determine the best algorithm

**Usage**

```
getBestModel(
  dates,
  values,
  freq,
  complete = 0,
  n_test = NA,
  graph = TRUE,
  algos = list("my.prophet", "my.ets", "my.sarima", "my.tbats", "my.bats", "my.stlm",
    "my.shortterm"),
  bagged = "auto",
  metric.error = my.rmse
)
```

**Arguments**

|                           |  |
|---------------------------|--|
| <code>dates</code>        | A vector of dates that can be parsed by lubridate  |
| <code>values</code>       | A vector of same size as dates   |
| <code>freq</code>         | A character string that indicates the frequency of the time series ("week", "month", "quarter", "day").                                  |
| <code>complete</code>     | A numerical value (or NA) to fill the missing data points  |
| <code>n_test</code>       | number of data points to keep aside for the test (default : one year)  |
| <code>graph</code>        | A boolean, if TRUE, comparison of algorithms is plotted  |
| <code>algos</code>        | A list containing the algorithms (strings, with prefix "my.") to be tested   |
| <code>bagged</code>       | A string. "auto" will use all available algorithms, skipping algos parameter. Else, specified algos of the 'algo' parameter will be used |
| <code>metric.error</code> | a function to compute the error the each models. available functions : my.rmse and my.mae  |

**Value**

A list containing a character string with the name of the best method, a gg object with the comparison between algorithms and a dataframe with predictions of all tried algorithms, a dataframe containing the errors of each algorithms, the preparedTS object and the list of algorithms tested

**Examples**

```
library(autoTS)
dates <- seq(lubridate::as_date("2005-01-01"),lubridate::as_date("2010-12-31"),"quarter")
values <- 10+ 1:length(dates)/10 + rnorm(length(dates),mean = 0,sd = 10)

which.model <- getBestModel(dates,values,freq = "quarter",n_test = 4)

### Custom set of algorithm (including for bagged estimator)
which.model <- getBestModel(dates,values,freq = "quarter",n_test = 4,
                           algos = list("my.prophet","my.ets"),bagged = "custom")

### Use MAE instead of RMSE

which.model <- getBestModel(dates,values,freq = "quarter",n_test = 3,
                           algos = list("my.prophet","my.ets"),
                           bagged = "custom",metric.error = my.mae)
```

---

|              |  |
|--------------|--|
| getFrequency | <i>Determines the decimal frequency of a time series from a character string</i> |
|--------------|--|

---

**Description**

Determines the decimal frequency of a time series from a character string

**Usage**

```
getFrequency(freq.alpha)
```

**Arguments**

freq.alpha      A character string that indicates the frequency of the time series ("week", "month", "quarter", "day").

**Value**

The decimal version of the frequency (useful for the forecast package functions).

**Examples**

```
getFrequency("week")
```

---

my.bats *Fit BATS algorithm and make the prediction*

---

**Description**

Fit BATS algorithm and make the prediction

**Usage**

```
my.bats(prepedTS, n_pred)
```

**Arguments**

|          |  |
|----------|--|
| prepedTS | A list created by the <code>prepare.ts()</code> function   |
| n_pred   | Int number of periods to forecast forward (eg n_pred = 12 will lead to one year of prediction for monthly time series) |

**Value**

A dataframe with 4 columns : date, average prediction, upper and lower 95

**Examples**

```
library(lubridate)
library(dplyr)
dates <- seq(as_date("2000-01-01"), as_date("2010-12-31"), "quarter")
values <- rnorm(length(dates))
my.ts <- prepare.ts(dates, values, "quarter", complete = 0)
my.bats(my.ts, n_pred=4)
```

---

my.ets *Fit ETS algorithm and make the prediction*

---

**Description**

Fit ETS algorithm and make the prediction

**Usage**

```
my.ets(prepedTS, n_pred)
```

**Arguments**

|          |  |
|----------|--|
| prepedTS | A list created by the <code>prepare.ts()</code> function   |
| n_pred   | Int number of periods to forecast forward (eg n_pred = 12 will lead to one year of prediction for monthly time series) |

**Value**

A dataframe with 4 columns : date, average prediction, upper and lower 95

**Examples**

```
library(lubridate)
library(dplyr)
dates <- seq(as_date("2000-01-01"), as_date("2010-12-31"), "quarter")
values <- rnorm(length(dates))
my.ts <- prepare.ts(dates, values, "quarter", complete = 0)
my.ets(my.ts, n_pred=4)
```

---

my.mae

*Custom (internal) function for MAE*

---

**Description**

Custom (internal) function for MAE

**Usage**

```
my.mae(true, predicted)
```

**Arguments**

|           |                                |
|-----------|--------------------------------|
| true      | num vector of actual values    |
| predicted | num vector of predicted values |

**Value**

Num value with MAE

---

my.predictions

*Make predictions with selected algorithms*

---

**Description**

Fit selected algorithms, make the predictions and combine the results along with observed data in one final dataframe.

**Usage**

```
my.predictions(
  bestmod = NULL,
  prepedTS = NULL,
  algos = list("my.prophet", "my.ets", "my.sarima", "my.tbats", "my.bats", "my.stlm",
              "my.shortterm"),
  n_pred = NA
)
```

**Arguments**

|          |   |
|----------|---|
| bestmod  | A list produced by the <code>getBestModel()</code> function (optional if <code>prepedTS</code> is provided)   |
| prepedTS | A list created by the <code>prepare.ts()</code> function (optional if <code>bestmod</code> provided)  |
| algos    | A list containing the algorithms to be implemented. If <code>bestmod</code> is supplied, this value is ignored, and taken from the best model object Using this option will overwrite the provided list of algorithms to implement them all |
| n_pred   | Int number of periods to forecast forward (eg <code>n_pred = 12</code> will lead to one year of prediction for monthly time series)   |

**Value**

A dataframe containing : date, actual observed values, one column per used algorithm, and a column indicating the type of measure (mean prediction, upper or lower bound of CI)

**Examples**

```
library(lubridate)
library(dplyr)
dates <- seq(lubridate::as_date("2000-01-01"),lubridate::as_date("2010-12-31"),"quarter")
values <- 10+ 1:length(dates)/10 + rnorm(length(dates),mean = 0,sd = 10)
### Stand alone usage
prepare.ts(dates,values,"quarter") %>%
  my.predictions(prepedTS = .,algos = list("my.prophet","my.ets"))
### Standard input with bestmodel

getBestModel(dates,values,freq = "quarter",n_test = 6) %>%
  my.predictions()
```

---

my.prophet

*Fit prophet algorithm and make the prediction*


---

**Description**

Fit prophet algorithm and make the prediction

**Usage**

```
my.prophet(prepedTS, n_pred)
```

**Arguments**

|          |  |
|----------|--|
| prepedTS | A list created by the prepare.ts() function  |
| n_pred   | Int number of periods to forecast forward (eg n_pred = 12 will lead to one year of prediction for monthly time series) |

**Value**

A dataframe for "next year" with 4 columns : date, average prediction, upper and lower 95

**Examples**

```
library(lubridate)
library(dplyr)
dates <- seq(as_date("2000-01-01"), as_date("2010-12-31"), "quarter")
values <- rnorm(length(dates))
my.ts <- prepare.ts(dates, values, "quarter", complete = 0)
my.prophet(my.ts, n_pred=4)
```

---

my.rmse

*Custom (internal) function for RMSE*

---

**Description**

Custom (internal) function for RMSE

**Usage**

```
my.rmse(true, predicted)
```

**Arguments**

|           |                                |
|-----------|--------------------------------|
| true      | num vector of actual values    |
| predicted | num vector of predicted values |

**Value**

Num value with RMSE



---

|           |   |
|-----------|---|
| my.sarima | <i>Fit SARIMA algorithm and make the prediction</i> |
|-----------|---|

---

**Description**

Fit SARIMA algorithm and make the prediction

**Usage**

```
my.sarima(prepedTS, n_pred)
```

**Arguments**

|          |  |
|----------|--|
| prepedTS | A list created by the <code>prepare.ts()</code> function   |
| n_pred   | Int number of periods to forecast forward (eg n_pred = 12 will lead to one year of prediction for monthly time series) |

**Value**

A dataframe with 4 columns : date, average prediction, upper and lower 95

**Examples**

```
library(lubridate)
library(dplyr)
dates <- seq(as_date("2000-01-01"), as_date("2010-12-31"), "quarter")
values <- rnorm(length(dates))
my.ts <- prepare.ts(dates, values, "quarter", complete = 0)
my.sarima(my.ts, n_pred=4)
```

---

|              |   |
|--------------|---|
| my.shortterm | <i>Fit short term algorithm and make the prediction</i> |
|--------------|---|

---

**Description**

Fit short term algorithm and make the prediction

**Usage**

```
my.shortterm(prepedTS, n_pred, smooth_window = 2)
```

**Arguments**

|               |   |
|---------------|---|
| prepedTS      | A list created by the <code>prepare.ts()</code> function  |
| n_pred        | Int number of periods to forecast forward (eg n_pred = 12 will lead to one year of prediction for monthly time series). Note that this algorithm cannot predict further than one year |
| smooth_window | Int specifying the number of periods to consider for computing the evolution rate that will be applied for the forecast   |

**Details**

this algorithm uses data of the last year and makes the prediction taking into account the seasonality and the evolution of the previous periods' evolution

**Value**

A dataframe with 4 columns : date, average prediction, upper and lower 95

**Examples**

```
library(lubridate)
library(dplyr)
dates <- seq(as_date("2000-01-01"), as_date("2010-12-31"), "quarter")
values <- rnorm(length(dates))
my.ts <- prepare.ts(dates, values, "quarter", complete = 0)
my.shortterm(my.ts, n_pred=4)
```

---

my.stlm

*Fit STLM algorithm and make the prediction*


---

**Description**

Fit STLM algorithm and make the prediction

**Usage**

```
my.stlm(prepedTS, n_pred)
```

**Arguments**

|          |  |
|----------|--|
| prepedTS | A list created by the <code>prepare.ts()</code> function   |
| n_pred   | Int number of periods to forecast forward (eg n_pred = 12 will lead to one year of prediction for monthly time series) |

**Value**

A dataframe with 4 columns : date, average prediction, upper and lower 95

**Examples**

```
library(lubridate)
library(dplyr)
dates <- seq(as_date("2000-01-01"),as_date("2010-12-31"),"quarter")
values <- rnorm(length(dates))
my.ts <- prepare.ts(dates,values,"quarter",complete = 0)
my.stlm(my.ts,n_pred=4)
```

---

my.tbats

*Fit TBATS algorithm and make the prediction*

---

**Description**

Fit TBATS algorithm and make the prediction

**Usage**

```
my.tbats(prepedTS, n_pred)
```

**Arguments**

|          |  |
|----------|--|
| prepedTS | A list created by the prepare.ts() function  |
| n_pred   | Int number of periods to forecast forward (eg n_pred = 12 will lead to one year of prediction for monthly time series) |

**Value**

A dataframe with 4 columns : date, average prediction, upper and lower 95

**Examples**

```
library(lubridate)
library(dplyr)
dates <- seq(as_date("2000-01-01"),as_date("2010-12-31"),"quarter")
values <- rnorm(length(dates))
my.ts <- prepare.ts(dates,values,"quarter",complete = 0)
my.tbats(my.ts,n_pred=4)
```

---

`prepare.ts`*Format 2 vectors in a proper object usable by all algorithms*

---

### Description

Format 2 vectors in a proper object usable by all algorithms

### Usage

```
prepare.ts(dates, values, freq, complete = 0)
```

### Arguments

|                       |   |
|-----------------------|---|
| <code>dates</code>    | A vector of dates that can be parsed by <code>lubridate</code>  |
| <code>values</code>   | A vector of same size as <code>dates</code>   |
| <code>freq</code>     | A character string that indicates the frequency of the time series ("week", "month", "quarter", "day"). |
| <code>complete</code> | A numerical value (or NA) to fill the missing data points   |

### Details

Creates a list with the time series in a dataframe and a ts object, and the frequency stored in decimal and literal values. The result is meant to be put in the prophet or forecast functions

### Value

A list containing : a dataframe, a ts vector for the time series, and 2 scalars for its frequency

### Examples

```
library(lubridate)
library(dplyr)
library(ggplot2)
dates <- seq(lubridate::as_date("2000-01-01"), lubridate::as_date("2010-12-31"), "quarter")
values <- rnorm(length(dates))
my.ts <- prepare.ts(dates, values, "month", complete = 0)
plot(my.ts$obj.ts)
ggplot(my.ts$obj.df, aes(dates, val)) + geom_line()
```

---

|                               |                                      |
|-------------------------------|--------------------------------------|
| <code>runUserInterface</code> | <i>Demo graphical user interface</i> |
|-------------------------------|--------------------------------------|

---

**Description**

A shiny application that allows the user to load a properly formatted CSV file, benchmark the algorithms, make a prediction and download the results. Requires additional packages shiny, shinycssloaders, tidyr and plotly to be installed

**Usage**

```
runUserInterface()
```

**Examples**

```
autoTS::runUserInterface()
```

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